Feedstock Opportunity Toolkit

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Baker Tilly at a glance

Baker Tilly is the 8th largest accounting network worldwide

- Top 20 largest firms in the U.S. consisting of more than 1,400 professionals
- Established in 1931
- Offices throughout the Midwest and East Coast
  - Chicago
  - Detroit
  - Minneapolis
  - New York
  - Washington DC
  - Wisconsin

Biogas Experience

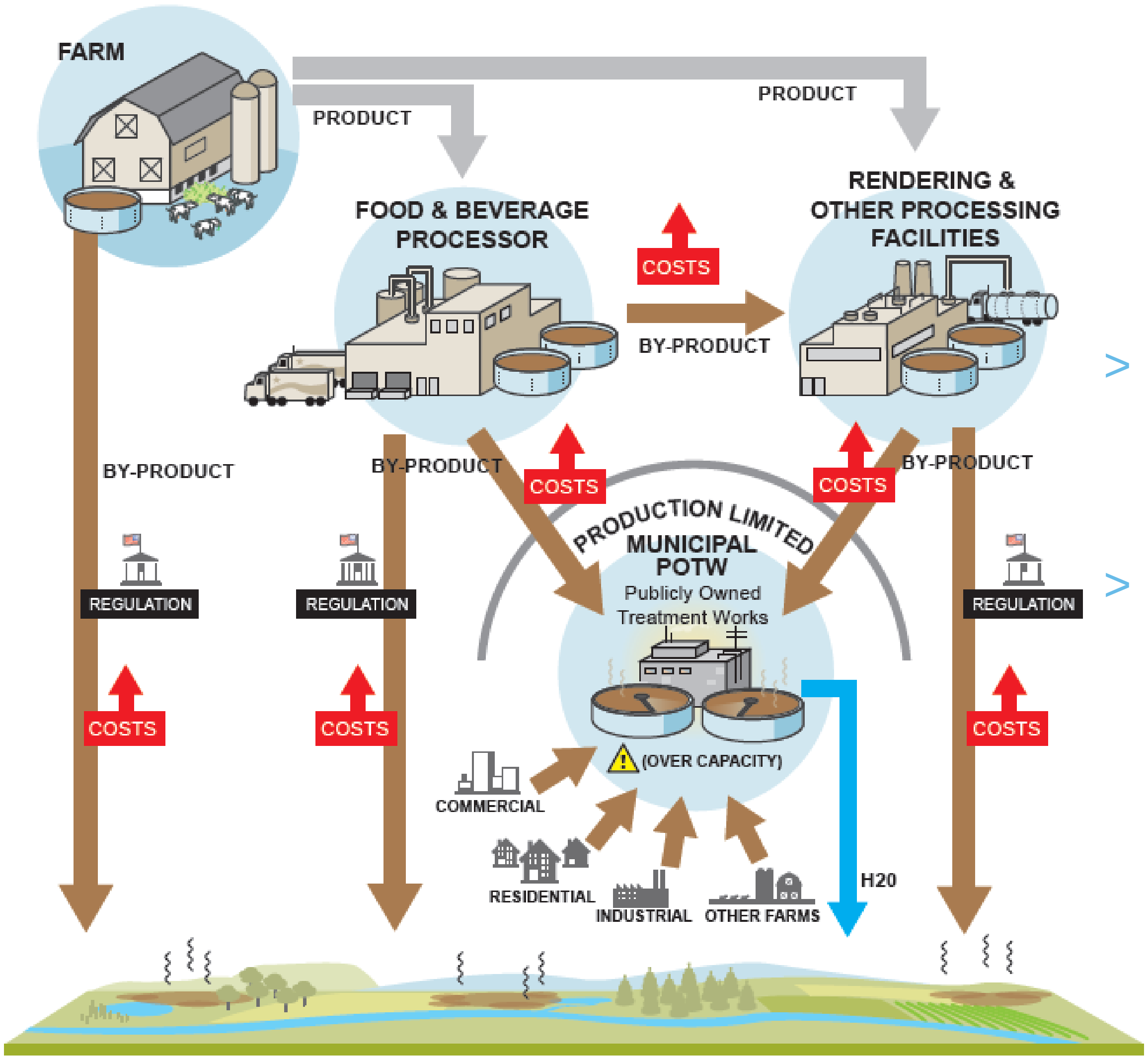
Baker Tilly has been involved with over 15 biogas projects that are either operating or under construction involving more than $200 million of funding.

- Accessing Federal Incentives (ITC, PTC, 1603 grants, NMTC's)
- Development Support
  - Feedstock agreements, PPA's, heat sale agreements, etc.
  - EPC, O&M and Technology procurement agreements
- Financial Advisory and Funding Procurement

Anaerobic Digestion and Defining the Feasibility of Waste to Energy Facilities

Historical/Current Case = Current/Future Project Drivers

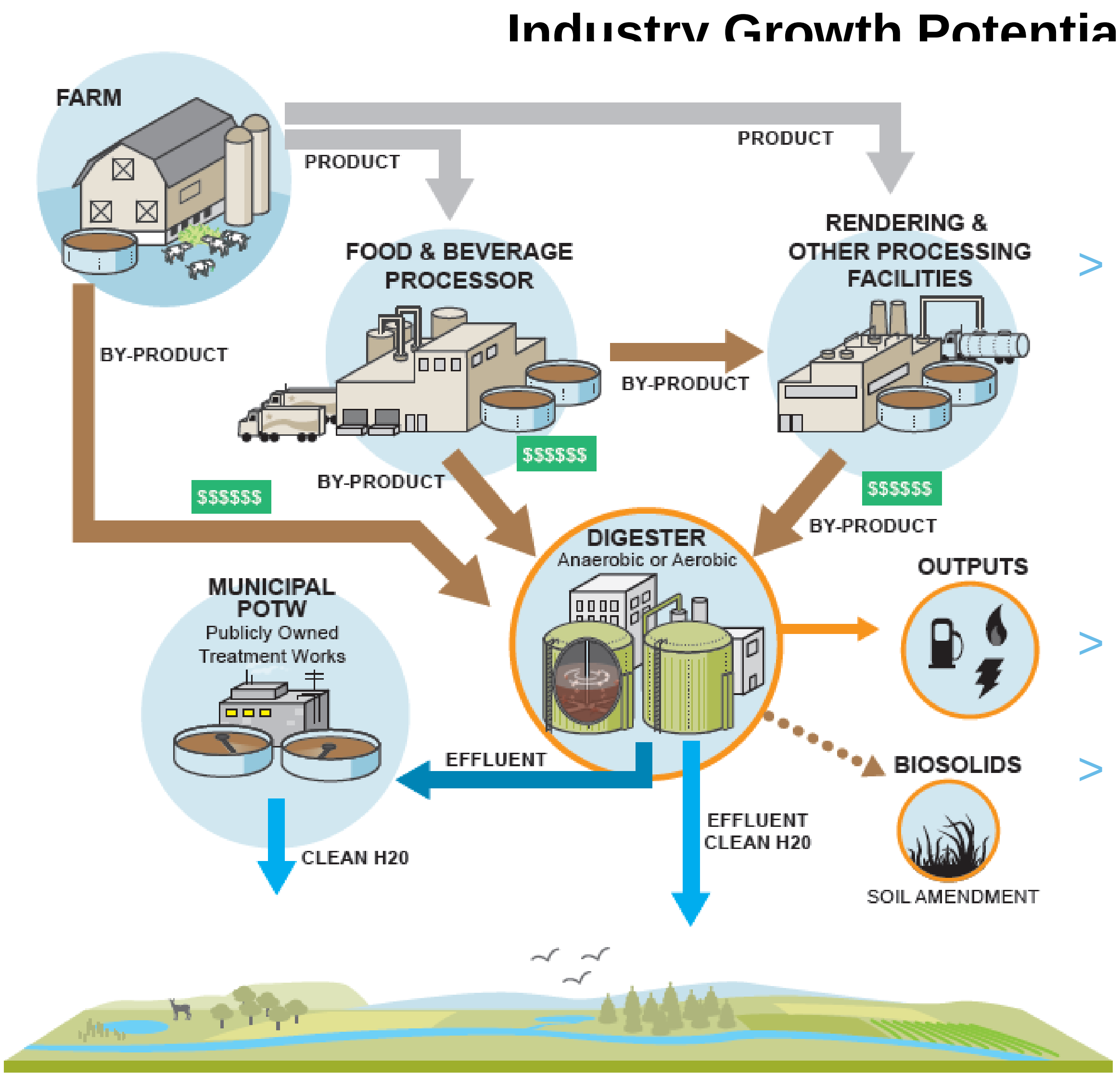
Current Growth Constraints



Primary Issues

- Cost
  - Disposal of waste
  - Energy
- Environmental
  - Regulatory compliance
  - Community impact

Potential Opportunities Afforded by Biogas Projects



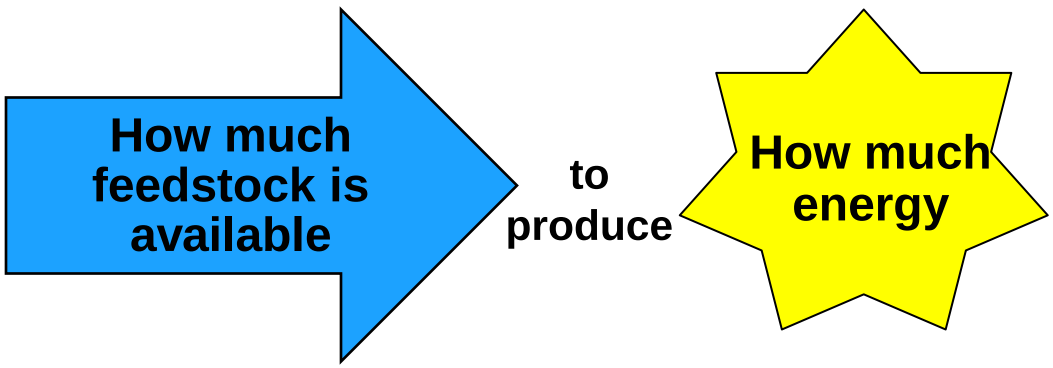
Primary Benefits

- Less risk regarding cost of disposal and energy
  - Long-term pricing stabilization
  - Possible reduction of current costs
- Ability to expand on existing footprint
- Ability to meet other sustainability goals whether mandated internally or externally

Feedstock Assessment Overview

> Scope Example:
- Dairy farming operations / Confined animal feeding operations (CAFOs)
- Cheese production facilities
- Publicly owned treatment works (POTW)

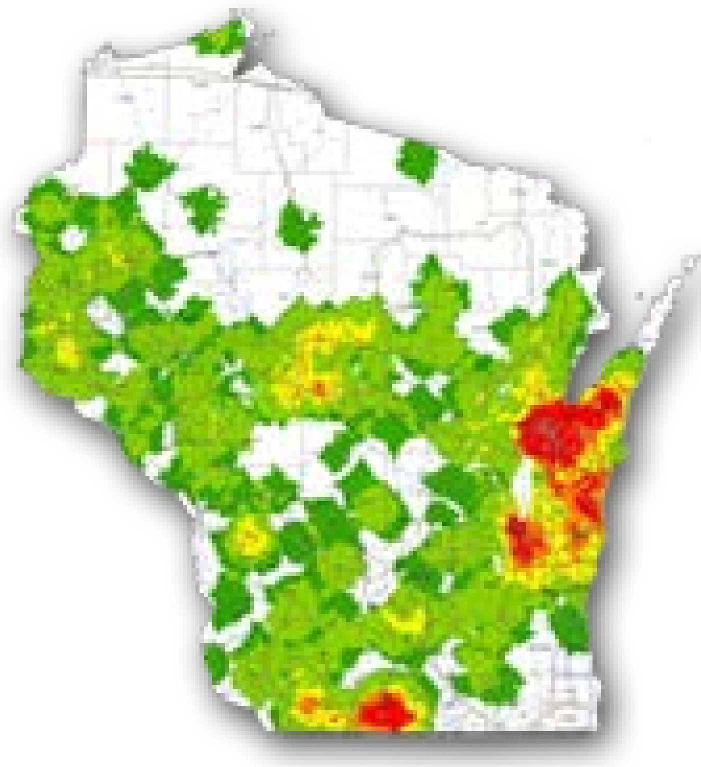
> Key factors in determining a viable application for energy production via agriculture/cheese waste feedstocks is understanding:



> And all those pesky externalities that come into play when actually developing a viable project…

Biogas Potential - Mapping Tool

> A mapping tool allows stakeholders to assess virtually any location in the state for relative biogas potential



http://www.bakertilly.com/Biogas-development-map

Feedstock Assessments for Biogas Projects

Feedstock Assessment

- There is no “one size fits all” approach to determine where feasible projects may exist

- A critical starting point is the evaluation of feedstock, from the high level assessment presented in this roadmap down to a very granular and source based

- State biogas to energy stakeholders should now have a clear understanding of the starting point for any biogas to energy project within the state

Economic Model and Developer Toolkit Overview

> A basic economic model and associated toolkit allows stakeholders to bring together the previous topics discussed

> Evaluate: “is the project potentially feasible?”, with “feasible” meaning different things to different project stakeholders, or project “Sponsors”

> A typical view of what is a feasible project is: “Can the project stand on its own as a viable business entity?”

- To understand how we get from that basic question to the answer, we must take a very high-level view of the concept of Project Finance

Model Basics

- Purpose: To perform an initial assessment of the economic potential of digesters at selected farms and dairy processing facilities

- Capabilities: The model is able to evaluate up to 10 farms and 10 processing facilities at the same time

- Within the model there are a number of "tabs" that interrelated:
  - Farm Sources Tab
  - Processing Facility Feedstock Tab
  - Power Generation Tab
  - Cost Estimates Tab
  - Financial Analysis Tab

http://www.bakertilly.com/Biogas-energy-digester

Model Basics – Farm Sources

- Includes ten assessment areas

- Final Result of the tab: The amount of the methane (CH4) on a yearly basis that could potentially be generated at the farm(s).

Farm 1	
Anaerobic Digestion - Inputs	**Inputs**
Animal type	Dairy
Number of animal units (AU=1000lb)	-
Animal unit	1.4
Manure (lb/AU/day)	82.00
Total manure (lb/day)	-
Moisture content (%)	0%
TSS content (%)	100%
Total moisture (gal/day)	-
Total TSS (lb/day)	-
COD per lb/AU/d	11.00
Total COD (lb)	-
Anaerobic Digestion - Reductions	
Flow (%)	1%
TSS (%)	5%
COD destruction rate(%)	70%
Anaerobic Digestion - Outputs	
Flow (gal/day)	-
TSS(lb)	-
COD (lb)	-
Power generation potential	
Methane per lb of COD (ft^3)	6.30
Methane potential per day (ft^3/day)	-
Total farm`s yearly methane potential CH4 (ft^3)	-

Economic Model Basics

Model Basics – Processing Facility Feedstock

> Includes ten assessment areas

> Final Result of the tab: The amount of methane on a yearly basis that could be potentially generated from the facility's waste

Processing facility 1	
Anaerobic Digestion - Inputs	**Inputs**
Total flow (gal/day)	-
TSS (%)	0%
Moisture content (%)	100%
Feedstock density (lb/gal)	8.30
Total TSS(lb/day)	-
BOD (lb/gal)	-
BOD/COD Conversion factor	1.60
COD(lb/gal)	-
Total COD (lb/day)	-
Anaerobic Digestion - Reductions	
Flow (%)	1%
TSS (%)	5%
COD destruction rate(%)	95%
Anaerobic Digestion - Outputs	
Flow (gal/day)	-
TSS(lb/day)	-
COD (lb/day)	-
Power generation potential	
Biogas per lb of COD (ft^3)	8.65
Percent CH4	65%
Methane potential per day (ft^3)	-
Total facility`s yearly biogas potential CH4 (ft^3)	-

Model Basics – Power Generation

Power generation assumptions		
Parameters	Default setting	User`s setting
Total CH4 Potential (ft³/hr)	-	-
Number of Engines	1	-
Available Gas Volume per Engine (cfm)	-	-
Electrical Output per Engine (kW)	-	-
Required Gas Volume per Engine (ft³/hr)	-	-
Heat Recovery Rate (MMbtu/hr)	-	-
Total CH4 Engine Volume (ft³/hr)	-	-
Total Engine Gross Electrical Output (Kw)	-	-
Electrical Efficiency (%)	0%	0%
Percent Plant Availability:	90%	0%
Total kWh/year	-	-
Average nameplate generation (kW/engin	-	-
Total nameplate generation (Kw)	-	-
On-Peak Energy Charge ($/kWh)	-	-
Off-Peak Energy Charge ($/kWh)	-	-
On-Peak Hours	-	-
Off-Peak Hours	8760	8760
Total Yearly Hours	8760	8760
Blended Electricity Rate ($/kWh)	0.0000	0.0000

Model Basics – Cost Estimates Tab

- Due to specifics of each project, the user needs to specify applicable cost categories

- In the absence of the specific cost estimates, the user could potentially use cost estimates generated by the AgSTAR program

INITIAL COSTS				
	Unit	Number of units	Cost per unit	Total
Facility & Equipment				
Equalization equipment (including screw press and storage silos)	$	0	-	-
Anaerobic reactors	$	0	-	-
Aerobic digester (water purifying)	$	0	-	-
Solids management equipment	$	0	-	-
Electrical generator(s)	$	1	-	-
Facility	$	0	-	-
Office equipment	$	0	-	-
Analytical equipment	$	1	-	-
Land improvements	$	0	-	-
Other	$	0	-	-
Total Facility Contingency	$	0%		-
Total Facility Costs	$			$ -

Model Basics – Financial Analysis

> The Financial Analysis Tab is organized into four steps:

- Step 1- Identify sources of funds
- Step 2- View the power generation outcome
- Step 3- Identify whether the processed waste is an expense or income
- Step 4- Identify financial inputs

Step 2 - Power Generation Outcome	Amount
Amount of waste from farms (ton/year)	
Amount of waste from facilities (ton/year)	
Nameplate capacity (kW)	
Yearly generation (kWh)	
Heat recovery (MMBtu/year)	
Renewable Energy Credits (based on MWh)	
* MMBtu = 1 million Btu	

Step 3 - Effluents: Input expenses and/or revenue			Fee
Expense	% of Volume	Amount	$/Unit
Flow (gal/year)	0%	-	-
TSS (ton/year)	0%	-	-
COD (ton/year)	0%	-	-
Revenue	% of Volume	Amount	$/Unit
Flow (gal/year)	100%	-	-
TSS (ton/year)	100%	-	-
COD (ton/year)	100%	-	-

Model Basics – Project Summary

Project Summary	
Heat & Power Generation Potential	
Number of farms	0
Number of processing facilities	0
Total methane potential (ft^3/hr)	0
Type of project	Heat & Electricity
Project nameplate capacity (kW)	0
Electricity generation (kWh/year)	-
Heat generation (MMBtu/year)	-
Project Budget and Returns	
Total initial costs ($)	0
Yearly O&M costs ($)	-
Electricity rate($/kWh)	-
Heat rate ($/MMBtu)	-
Y1 Pretax income ($)	-
Y1 Debt Coverage Ratio	n/a
Net Preset Value ($)	-
Internal Rate of Return (%)	#NUM!

Private development of high strength liquid waste digester with 3.0+ MW from 5+ large food manufacturers' feedstocks

- Primary Driver – long-term cost and environmental risk associated with land application of waste water
- Assembled long-term (10-years) feedstock contracts w/tipping fees
- Able to procure power purchase agreement at adequate rate
- Utilized proven technologies with performance guarantees acceptable to debt community (non recourse debt)
- Utilized combination of equity, mezzanine funds, vendor financing state loans, NMTC funds and debt to finance (approx. $28.5 MM project)

Public expansion turned private development with 1.5+ MW of electrical power from 3 large food manufacturers’ feedstocks

- Primary Driver – Opportunity to expand core manufacturing and manage odors in community with overburdened POTW
- Formed joint venture to take advantage of economies of scale
- Negotiated 20 year power sales with local utility at adequate rates
- Paired NMTC and 1603 grant to offset capital costs of project
- $30 MM investment

Speaker Bio

Candor. Insight. Results.

Joel Laubenstein

Manager

Energy & Utilities

- Joined Baker Tilly's Renewable Energy Development Support team in 2008
- Specializes in new business opportunities in renewable energy
- Provides overall project development for renewable energy developers
- Technology experience: biogas, wind, solar, geothermal

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